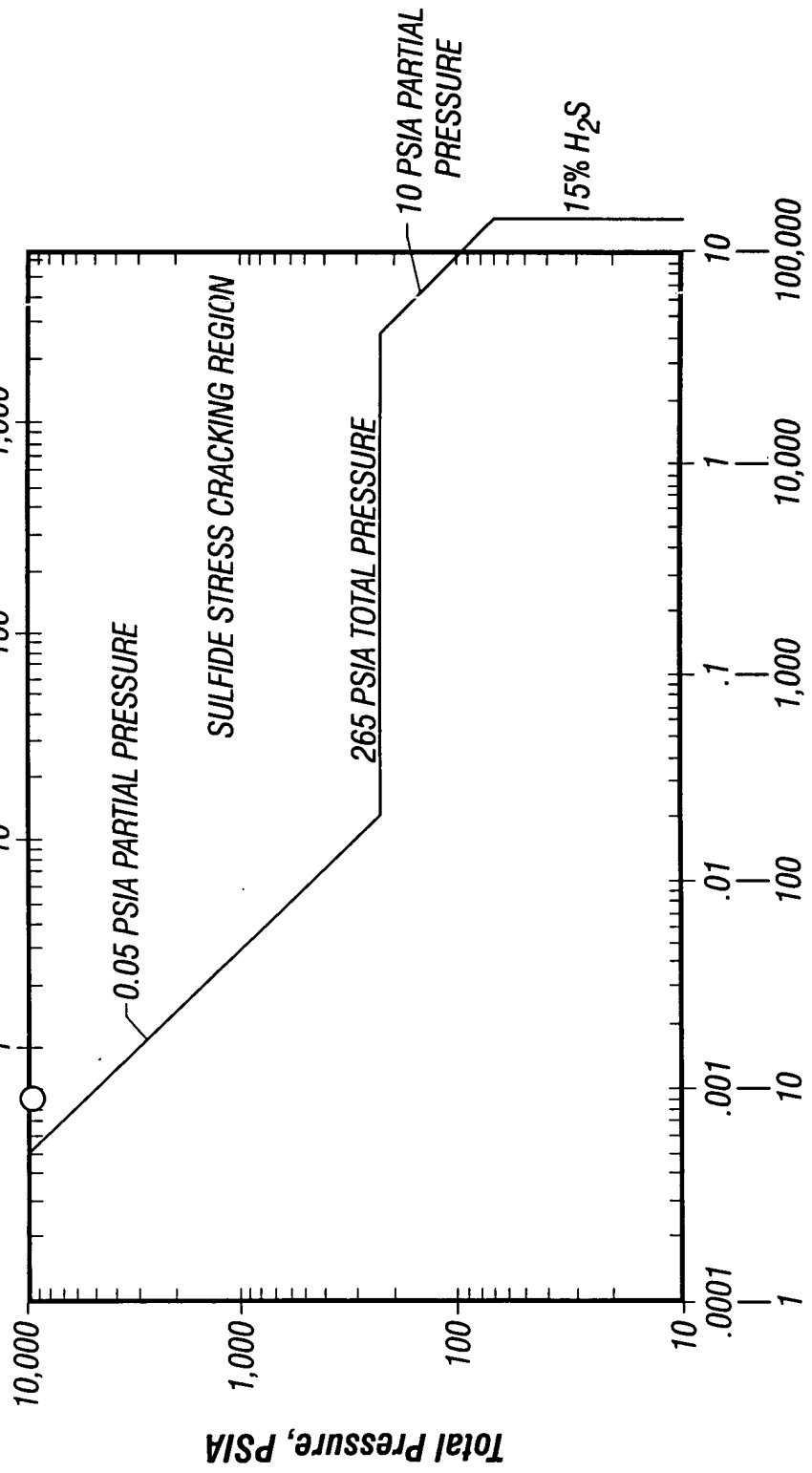
10 PSIA PARTIAL PRESSURE
15% H_2S
SULFIDE STRESS CRACKING REGION
265 PSIA TOTAL PRESSURE
0.05 PSIA PARTIAL PRESSURE
Total Pressure, PSIA
10,000
1,000
100
10
1
1,000
100
10
1
.1
.01
.001
.0001
10
1
100
10,000
100,000
MOL % H_2S In Gas
PPM H_2S In Gas

FIG. 1

RAW MATERIAL BAR STOCK	
ALLOY	$/lb
4130	1.0
4140	1.0
9Cr	1.5
410-13Cr	2.0
420 MOD.	2.0
17-4	3.0
304	2.5
316	3.0
S13Cr	5.0
450	6.0
918	5.5
MONEL K-500	12
925	11.5
718	12
625M	20
725	20
C-276	50
MP35N	60

FIG. 3

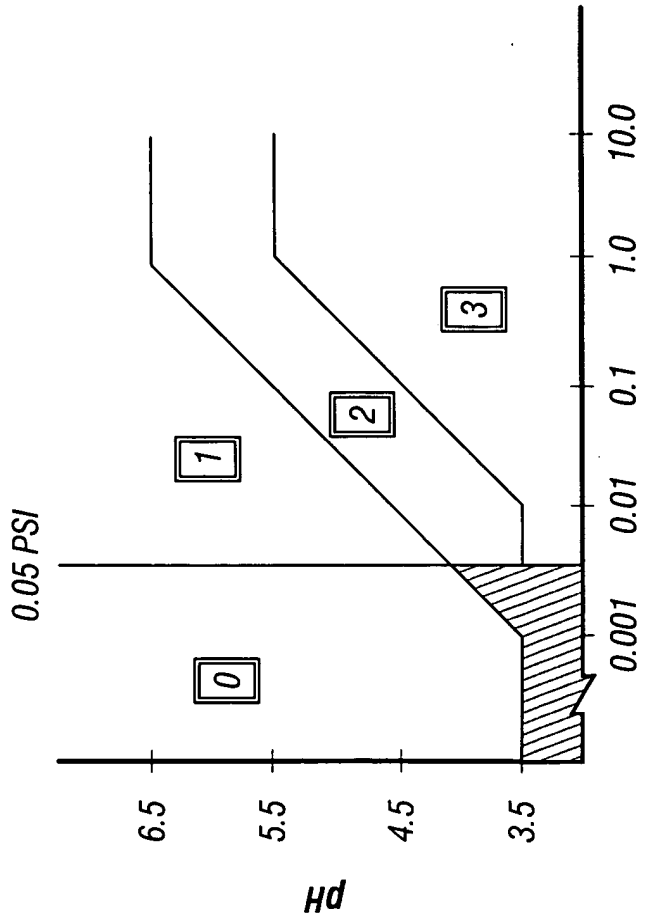

FIG. 2

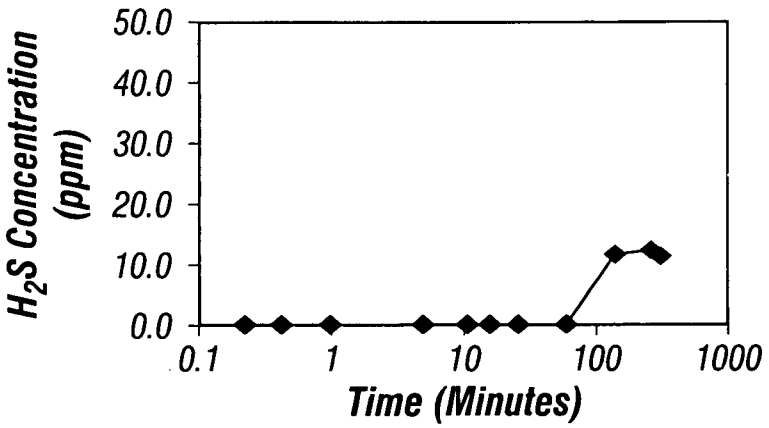

FIG. 4

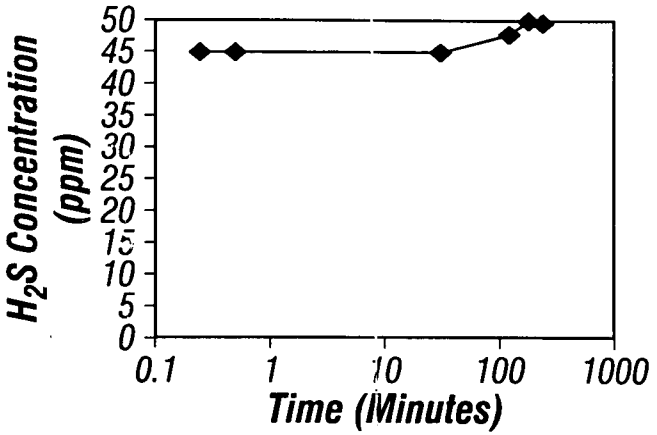

FIG. 5

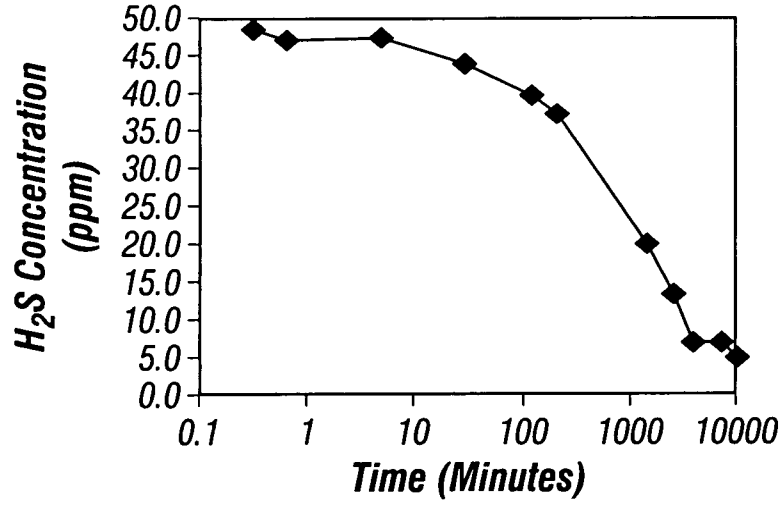

FIG. 6

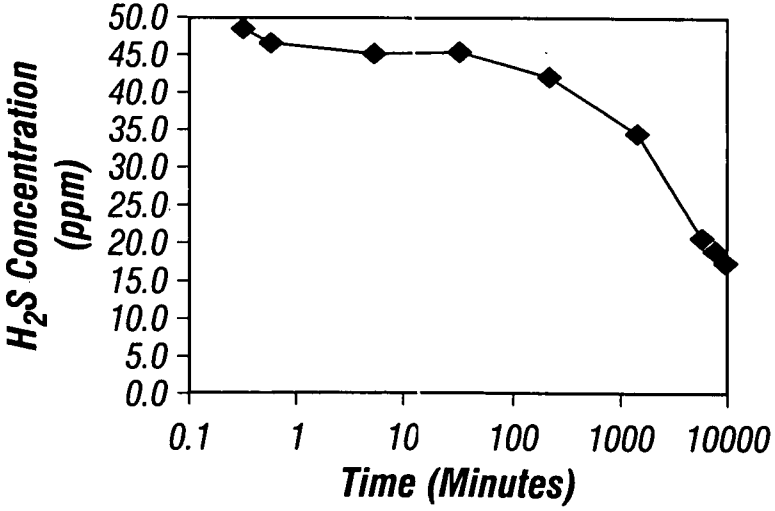

FIG. 7

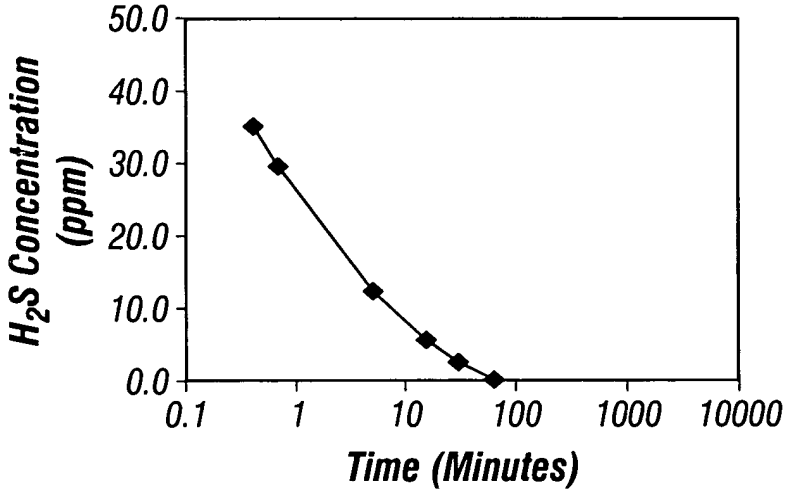
50.0
40.0
30.0
20.0
10.0
0.0
H_2S Concentration (ppm)
0.1
1
10
100
1000
10000
Time (Minutes)

FIG. 8

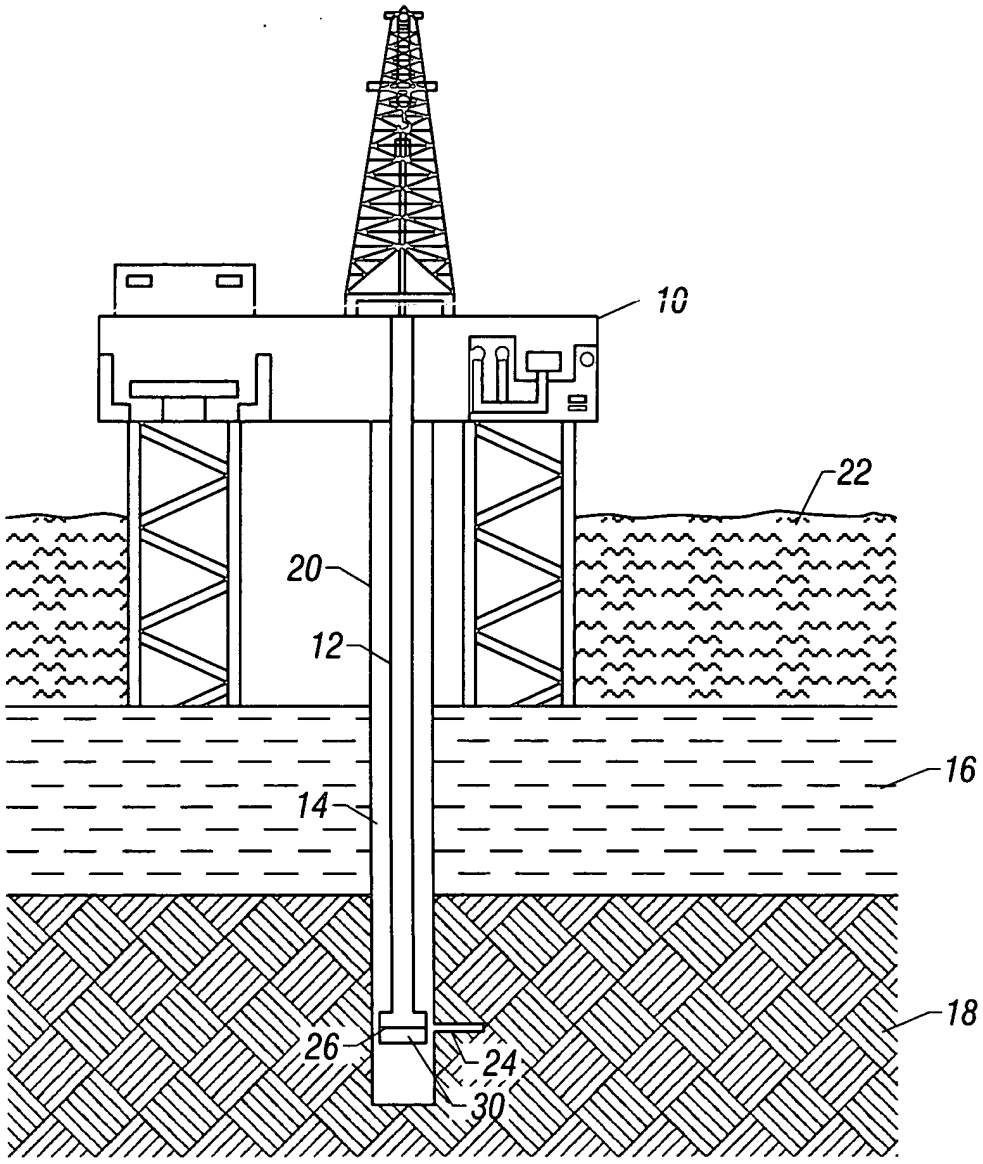

FIG. 9

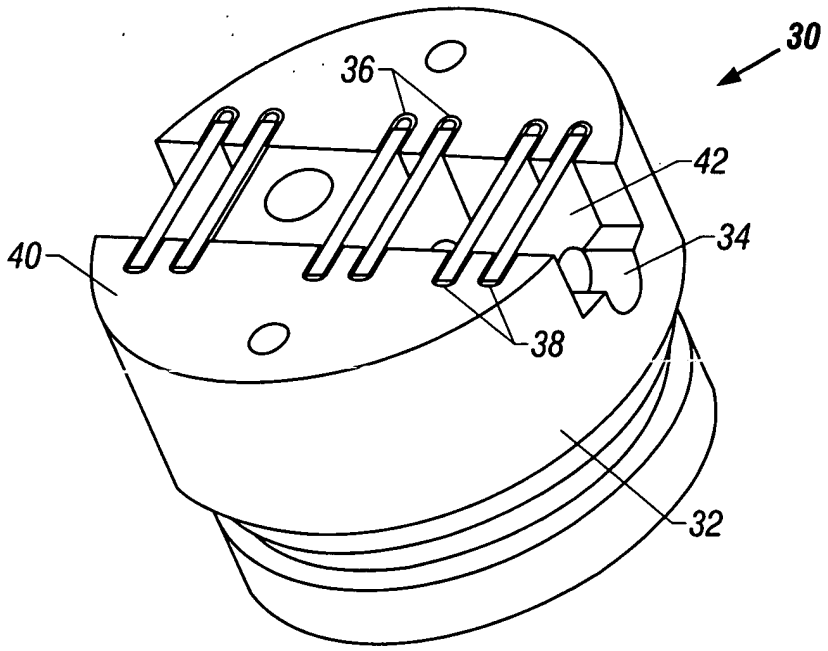

FIG. 10

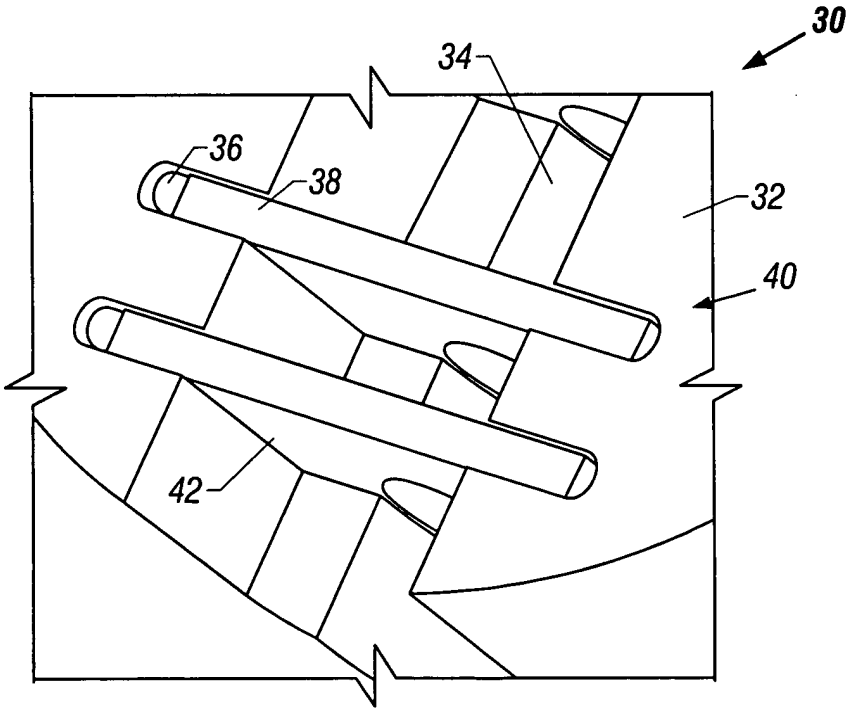

FIG. 11

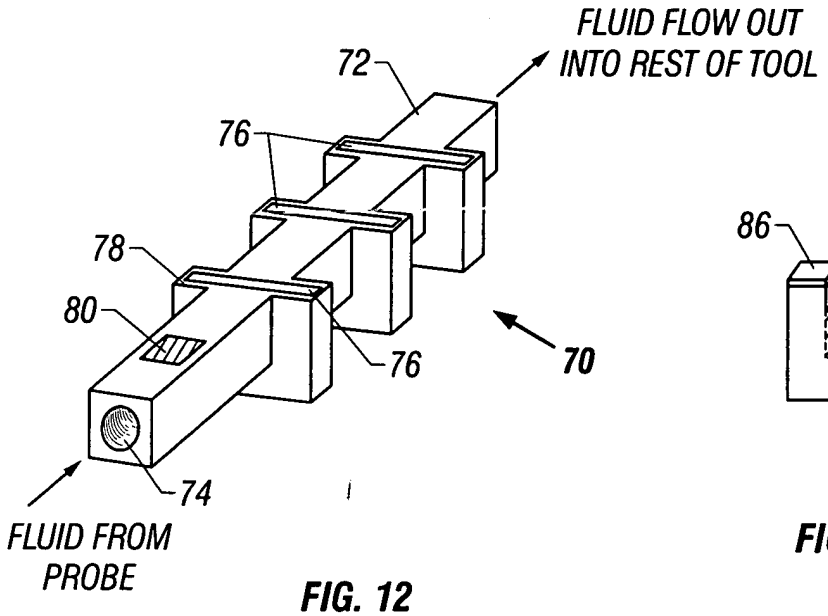

FIG. 12

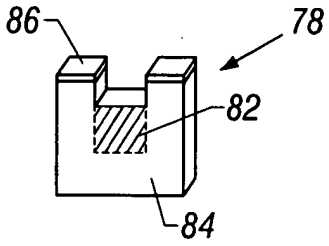

FIG. 13

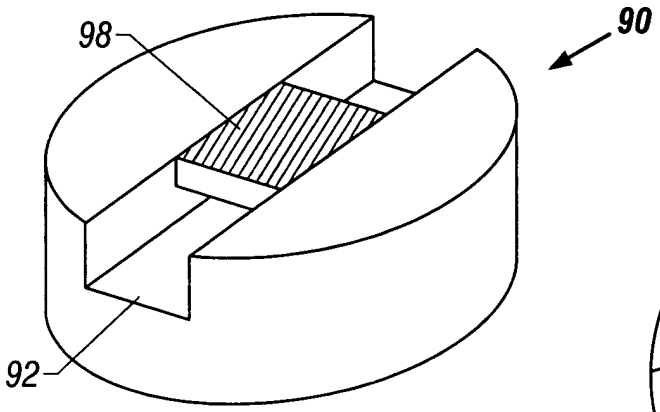

FIG. 14

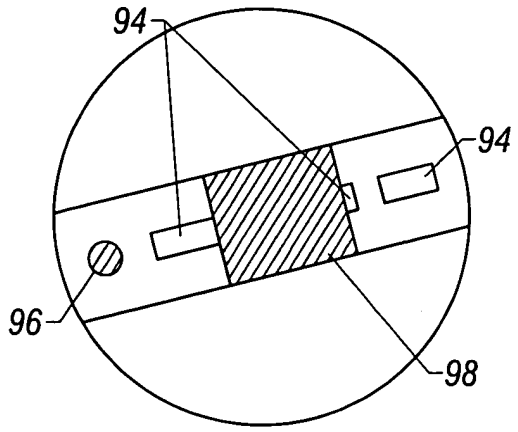

FIG. 15

ALLOY	Ni	Cu	Fe	Cr	Mo
MONEL ALLOY 400 N04400	63 - 70	BAL.	2.5 MAX.	--	--
70-30 CUPRONICKEL C71500	29 - 33	BAL.	0.4 - 1.0	--	--
90-10 CUPRONICKEL C70600	9 - 11	86.5 MIN.	1.0 - 1.8	--	--
NICKEL ALLOY 200 N02200	99.0 MIN.	0.25 MAX.	0.40 MAX.	--	--
ALLOY B N10001	BAL.	--	6.0 MAX.	1.0 MAX.	26 - 33
INCOLOY ALLOY 600 N06600	72 MIN.	.50 MAX.	6 - 10	14 - 17	--
5CR STEEL K41545	--	--	BAL.	4 - 6	0.45 - 0.65
9CR STEEL K90941	--	--	BAL.	8 - 10	0.9 - 1.1
12CR STEEL S41000	--	--	BAL.	11.5 - 13.5	--

FIG. 16

TEST NO.	H_2S (PPM)	DURATION (HR.)	TEMP. (F)	MONEL 400	70/30 CuNi	90/10 Cu/Ni	NI 200	ALLOY 600	ALLOY B
				CONDITION OF COUPONS AFTER EXPOSURE					
1*	0	6	250	O	O	ST	--	--	--
2*	0	2	400	O	ST	ST	--	--	--
3	0	2	250	ST	ST	ST	--	--	--
4	50	2	250	G	DG	DG	--	--	--
5	0	2	300	ST	ST	ST	--	--	--
6	50	2	300	DG	G	DG	--	--	--
7	0	2	350	ST	ST	ST	--	--	--
8	50	2	350	DG	G	DG	--	--	--
9	0	2	400	ST	ST	ST	--	--	--
10	50	2	400	DG	G	G	--	--	--
11	25	2	300	DG	G	DG	--	--	--
12	25	6	300	DG	G	G	--	--	--
13	10	2	300	DG	G	G	--	--	--
14	10	2	300	DG	G	DG	--	--	--
15	5	2	300	DG	G	G	--	--	--
16	25	2	300	DG	G	DG	G	ST	DG
17	10	2	300	DG	G	DG	ST	ST	ST
18	18	2	300	DG	G	G	ST	ST	G

NOTES :
O - NO ATTACK
ST - SLIGHT TARNISH
G - GRAY CORROSION FILM
DG - DARK GRAY CORROSION FILM

* TEST CONTAINED OIL MUD AS LIQUID PHASE

FIG. 17

TEST NO.	H_2S (PPM)	DURATION (HR.)	TEMP. (F)	5Cr	9Cr	12Cr	316 SS	Ni200	ALLOY 600	ALLOY B
				CONDITION OF COUPONS AFTER EXPOSURE						
201*	25	2	250	G	G	G	O	DG	T	B
301*	50	2	250	G	G	G	O	G	T	G
401	25	2	250	G	G	G	G	G	G	DG
501	50	2	250	DG	DG	G	LG	G	G	DG
601	100	2	250	DG/B	DG/B	DG/B	LG	LG	B	G
701	50	2	250	DG	DG	B	LG	G	G	LG
801	75	2	250	DG	DG	DG	LG	LG	DG	G
901	100	2	300	DG	DG	DG	LG	LG	B	G
1001	75	2	300	DG	G	DG	LG	LG	B	G
1101	50	2	300	DG	DG	DG	LG	LG	B	G
1201	100	2	250	DG	DG	DG	G	G	BB	G
1301	75	2	300	G/B	G/B	G/B	G	G	B	G
1401	50	2	350	DG	DG	DG	G	G	DG	G
1501	75	2	350	DG	DG	G	G	LG	G	DG
1601	100	2	350	G/B	DG	DG	G	G	G	G

NOTEES :
O - NO ATTACK
ST - SLIGHT TARNISH
LG - LIGHT GRAY CORROSION FILM
G - GRAY CORROSION FILM
DG - DARK GRAY CORROSION FILM
B - BLACK CORROSION FILM

* COUPONS IN VAPOR PHASE

10/15

FIG. 18

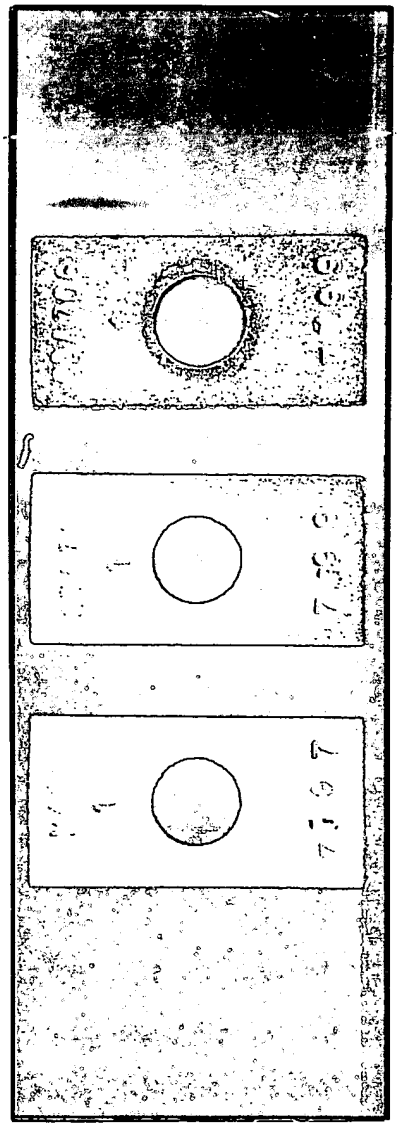

FIG. 19A

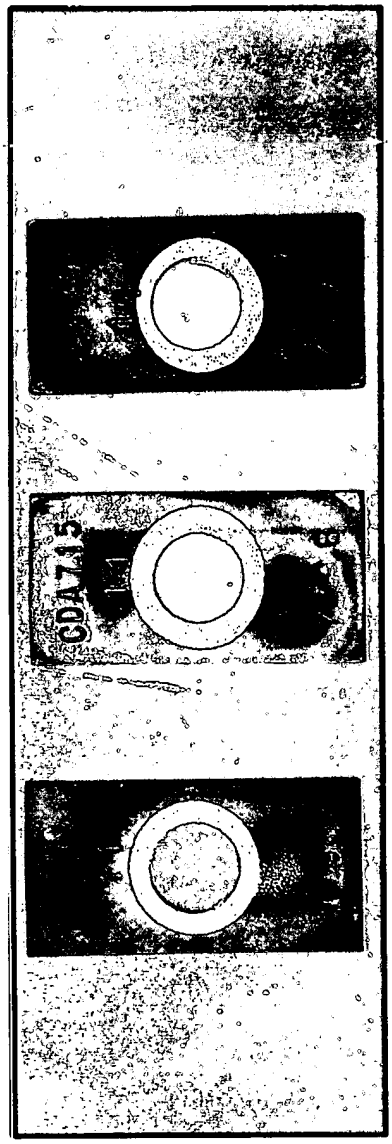

FIG. 19B

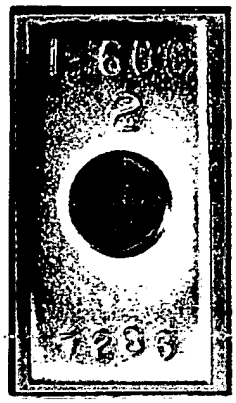

FIG. 20A

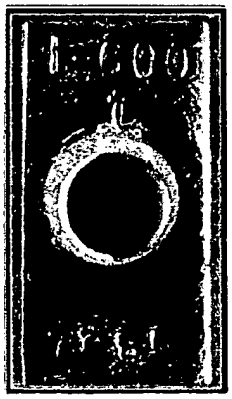

FIG. 20B

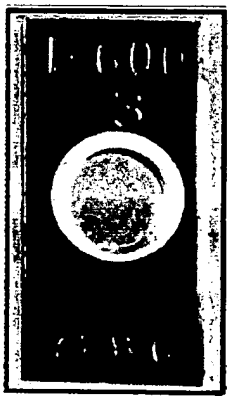

FIG. 20C

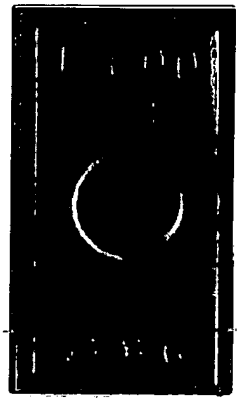

FIG. 20D

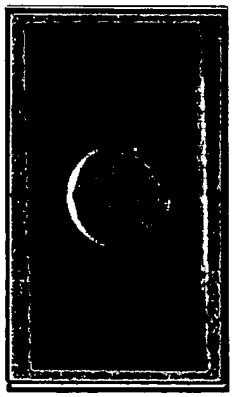

FIG. 20E

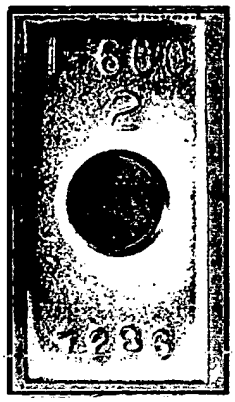

FIG. 21A

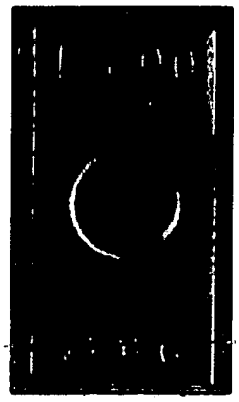

FIG. 21D

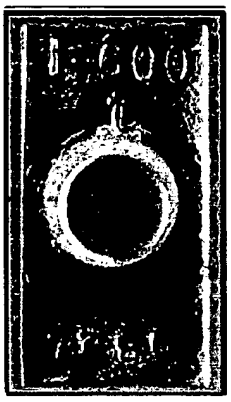

FIG. 21B

FIG. 21E

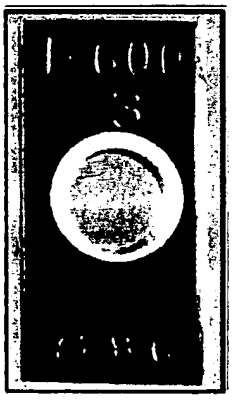

FIG. 21C

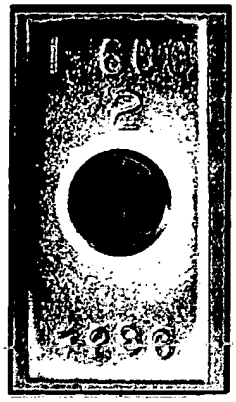

FIG. 22A

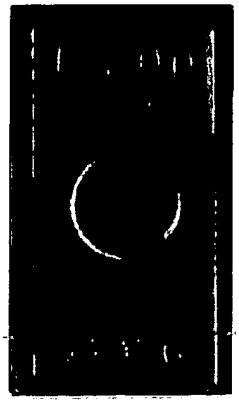

FIG. 22D

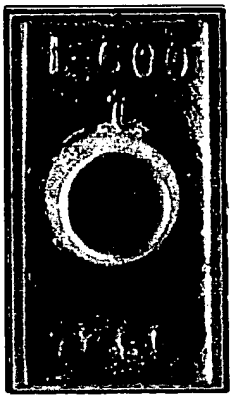

FIG. 22B

FIG. 22E

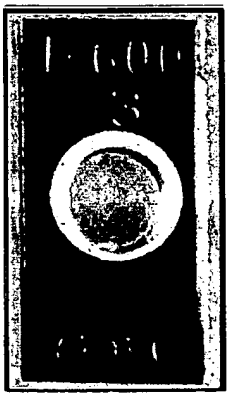

FIG. 22C

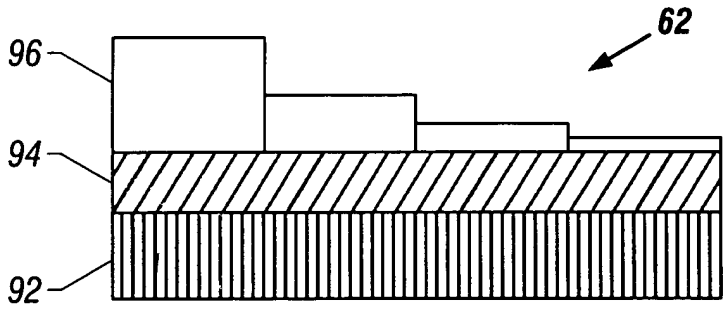

FIG. 23

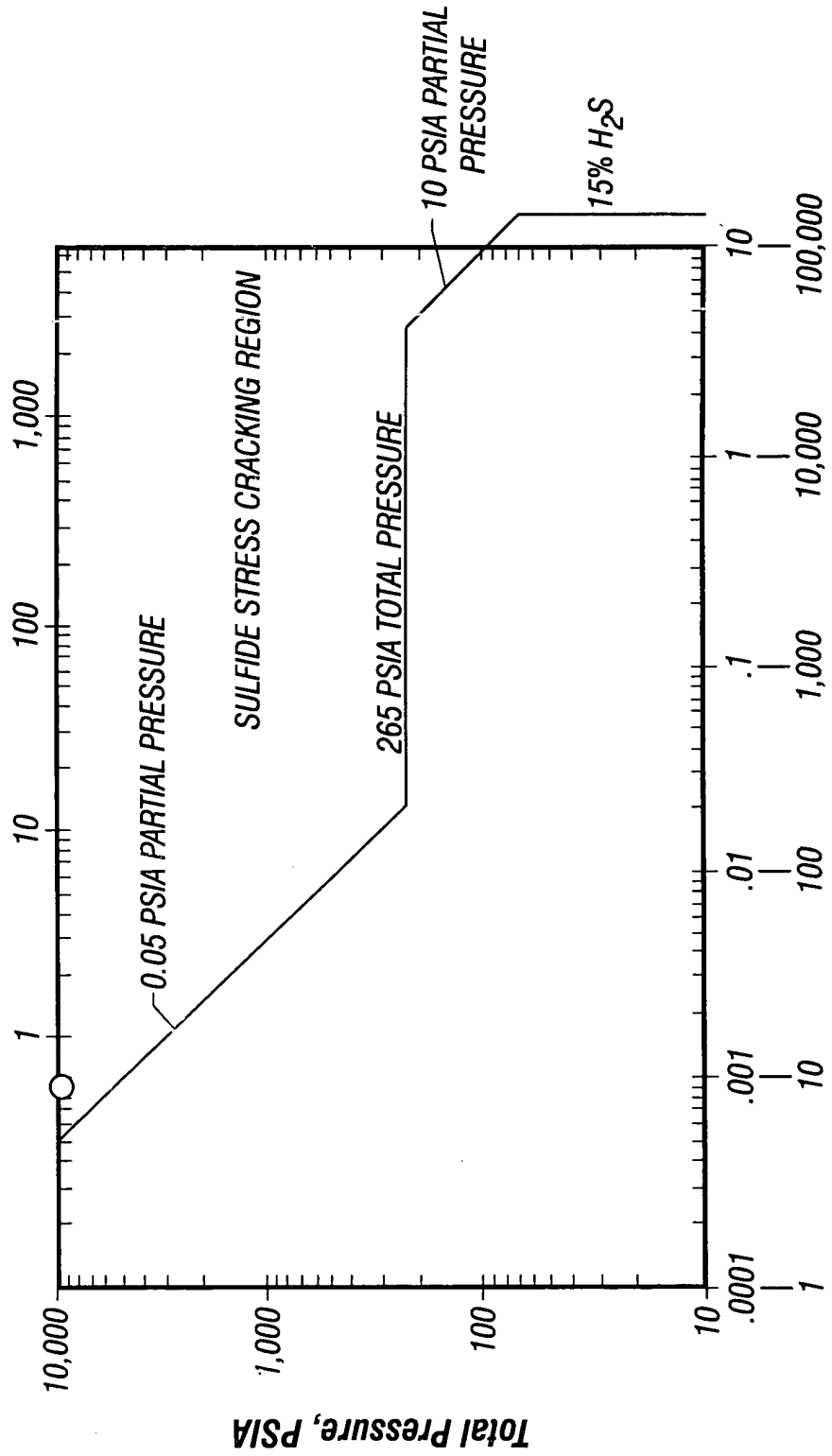
10 PSIA PARTIAL PRESSURE
15% H_2S
SULFIDE STRESS CRACKING REGION
0.05 PSIA PARTIAL PRESSURE
265 PSIA TOTAL PRESSURE
Total Pressure, PSIA
10,000
1,000
100
10
1
10
100
1,000
10,000
100,000
.0001
.001
.01
.1
1
10
100
1,000
MOL % H_2S In Gas
PPM H_2S In Gas

FIG. 1

RAW MATERIAL BAR STOCK	
ALLOY	$/lb
4130	1.0
4140	1.0
9Cr	1.5
410-13Cr	2.0
420 MOD.	2.0
17-4	3.0
304	2.5
316	3.0
S13Cr	5.0
450	6.0
918	5.5
MONEL K-500	12
925	11.5
718	12
625M	20
725	20
C-276	50
MP35N	60

FIG. 3

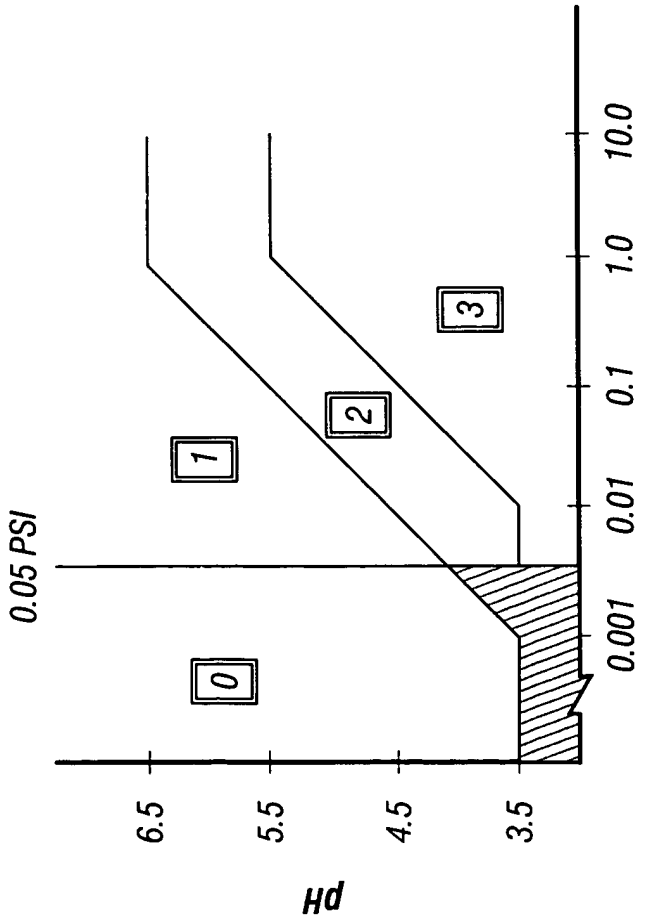

FIG. 2

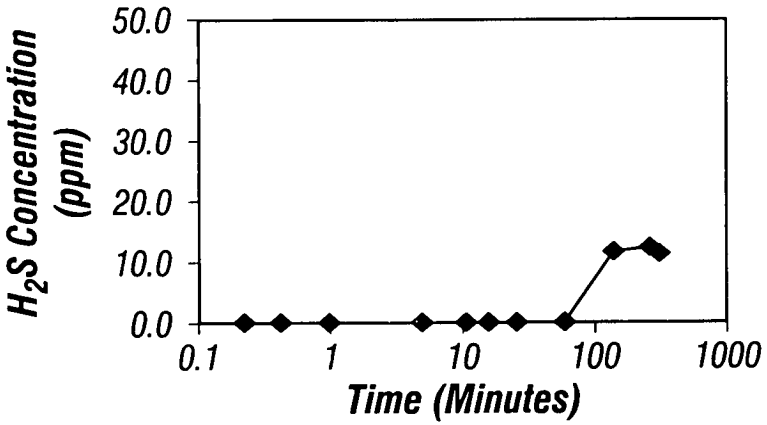

FIG. 4

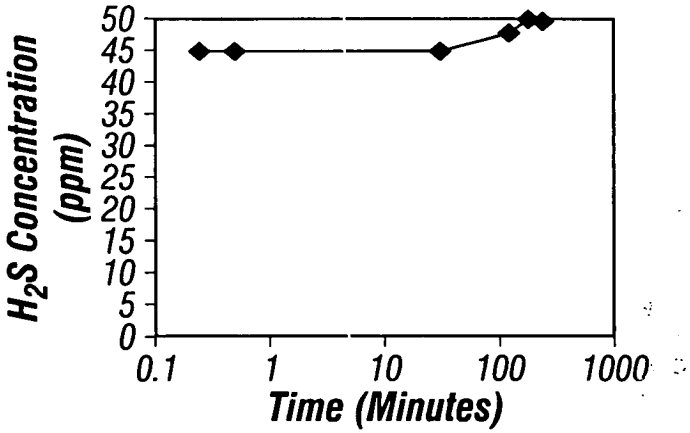

FIG. 5

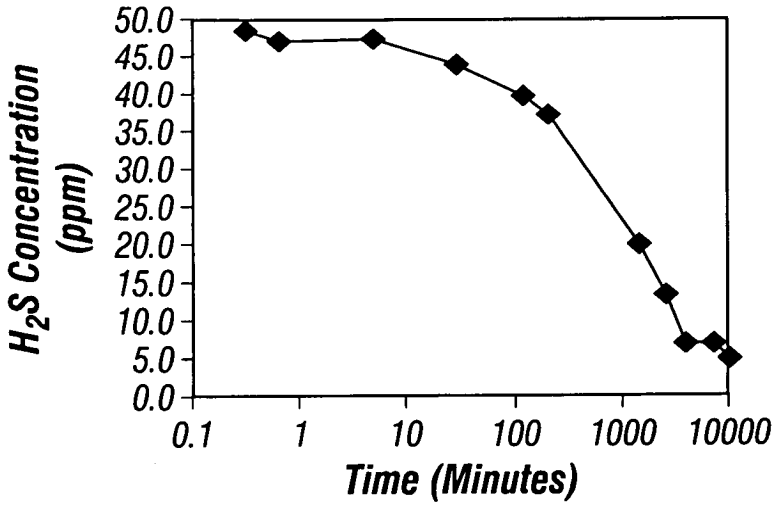

FIG. 6

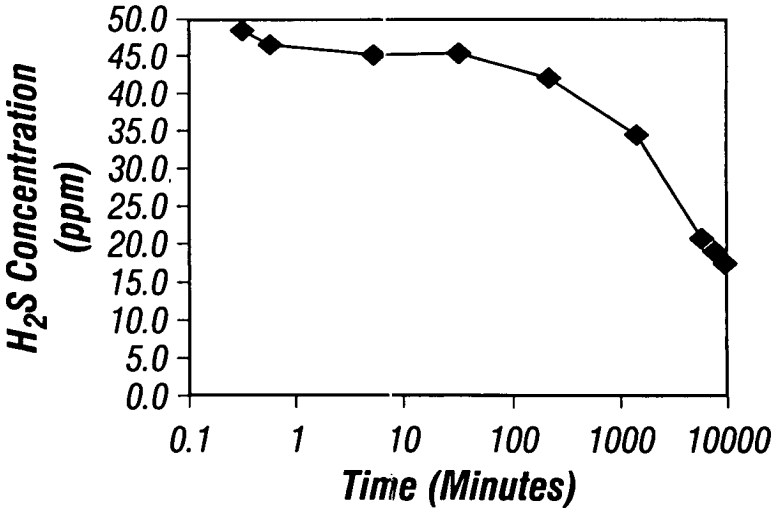

FIG. 7

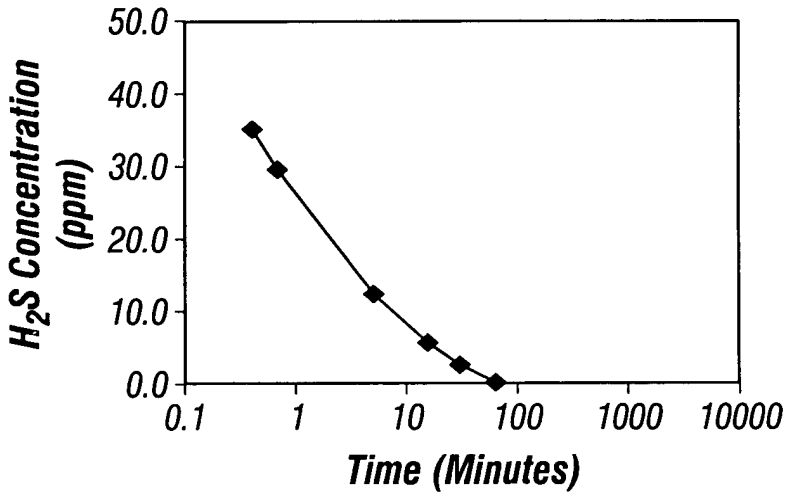
50.0
40.0
30.0
20.0
10.0
0.0
H_2S Concentration (ppm)
0.1
1
10
100
1000
10000
Time (Minutes)

FIG. 8

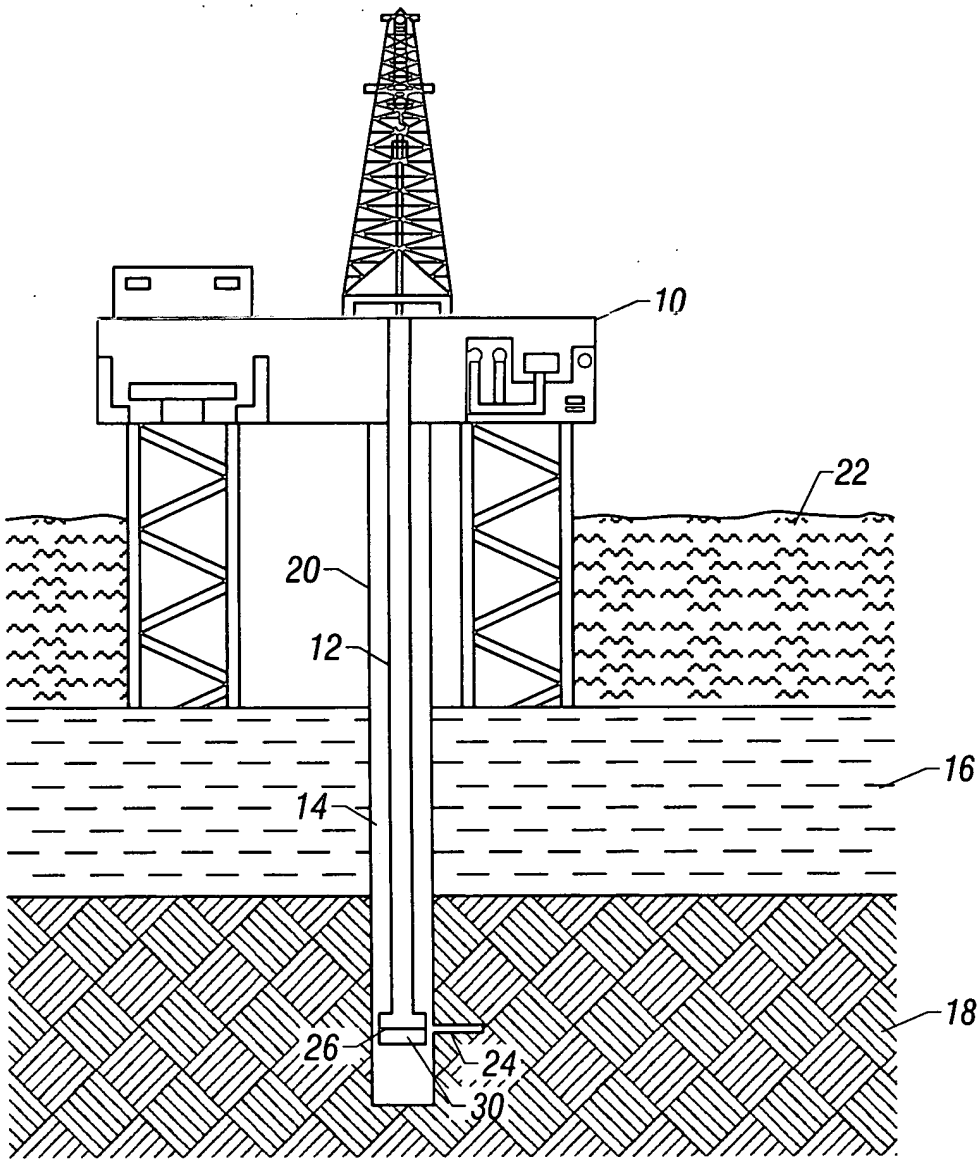

FIG. 9

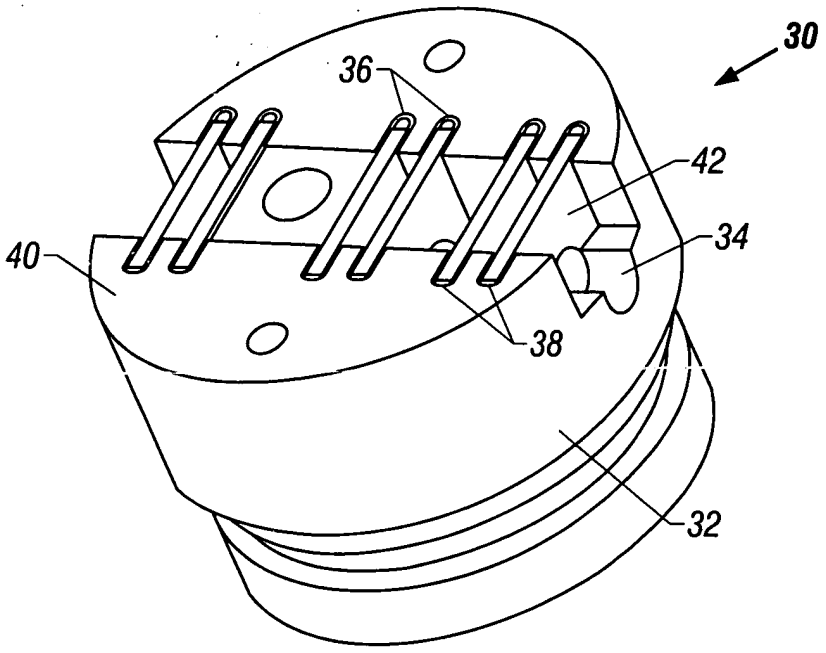

FIG. 10

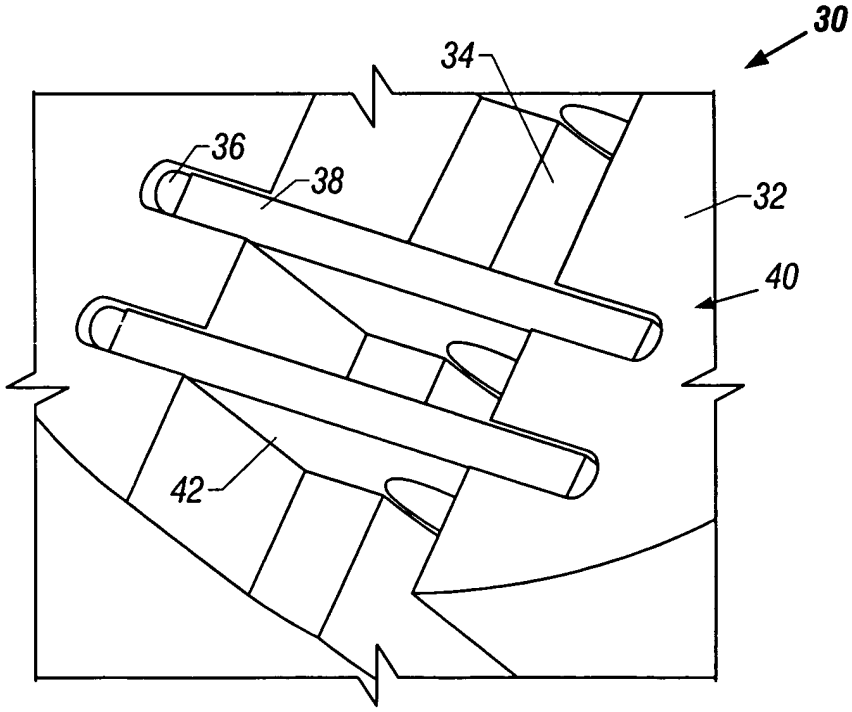

FIG. 11

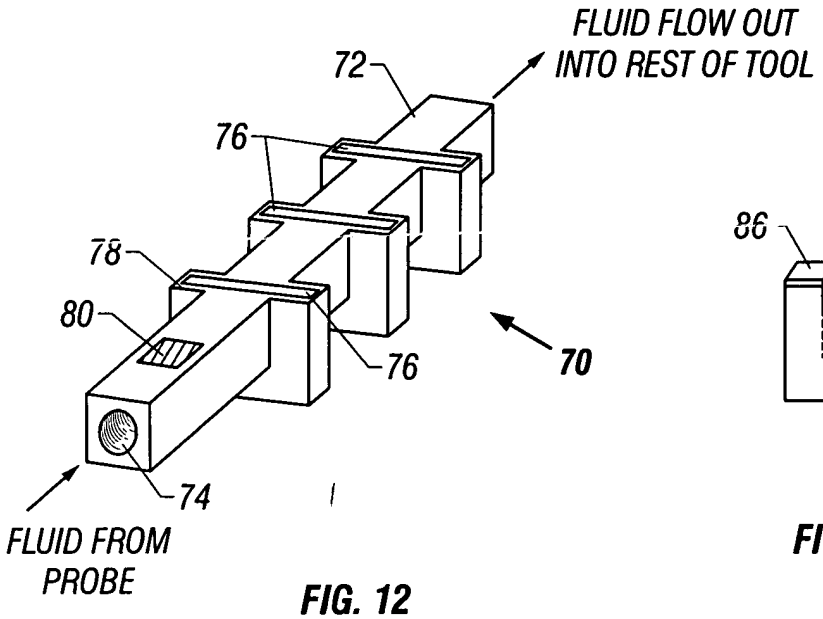

FIG. 12

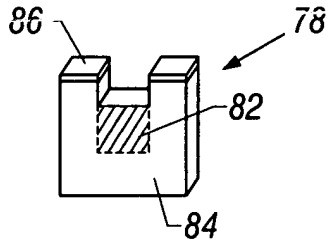

FIG. 13

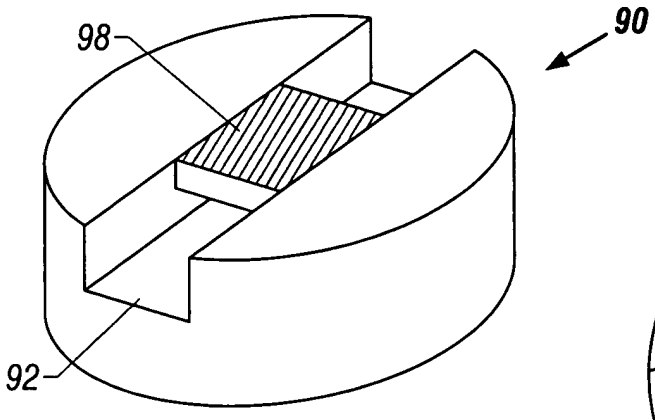

FIG. 14

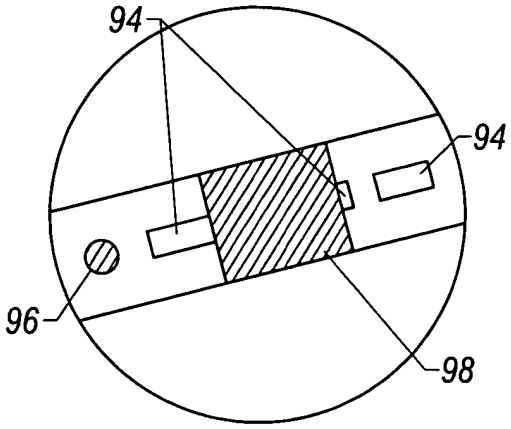

FIG. 15

ALLOY	Ni	Cu	Fe	Cr	Mo
MONEL ALLOY 400 N04400	63 - 70	BAL.	2.5 MAX.	--	--
70-30 CUPRONICKEL C71500	29 - 33	BAL.	0.4 - 1.0	--	--
90-10 CUPRONICKEL C70600	9 - 11	86.5 MIN.	1.0 - 1.8	--	--
NICKEL ALLOY 200 N02200	99.0 MIN.	0.25 MAX.	0.40 MAX.	--	--
ALLOY B N10001	BAL.	--	6.0 MAX.	1.0 MAX.	26 - 33
INCOLOY ALLOY 600 N06600	72 MIN.	.50 MAX.	6 - 10	14 - 17	--
5CR STEEL K41545	--	--	BAL.	4 - 6	0.45 - 0.65
9CR STEEL K90941	--	--	BAL.	8 - 10	0.9 - 1.1
12CR STEEL S41000	--	--	BAL.	11.5 - 13.5	--

FIG. 16

TEST NO.	H_2S (PPM)	DURATION (HR.)	TEMP. (F)	MONEL 400	70/30 CuNi	90/10 Cu/Ni	NI 200	ALLOY 600	ALLOY B
				CONDITION OF COUPONS AFTER EXPOSURE					
1*	0	6	250	O	O	ST	--	--	--
2*	0	2	400	O	ST	ST	--	--	--
3	0	2	250	ST	ST	ST	--	--	--
4	50	2	250	G	DG	DG	--	--	--
5	0	2	300	ST	ST	ST	--	--	--
6	50	2	300	DG	G	DG	--	--	--
7	0	2	350	ST	ST	ST	--	--	--
8	50	2	350	DG	G	DG	--	--	--
9	0	2	400	ST	ST	ST	--	--	--
10	50	2	400	DG	G	G	--	--	--
11	25	2	300	DG	G	DG	--	--	--
12	25	6	300	DG	G	G	--	--	--
13	10	2	300	DG	G	G	--	--	--
14	10	2	300	DG	G	DG	--	--	--
15	5	2	300	DG	G	G	--	--	--
16	25	2	300	DG	G	DG	G	ST	DG
17	10	2	300	DG	G	DG	ST	ST	ST
18	18	2	300	DG	G	G	ST	ST	G

NOTES :
O - NO ATTACK
ST - SLIGHT TARNISH
G - GRAY CORROSION FILM
DG - DARK GRAY CORROSION FILM

* TEST CONTAINED OIL MUD AS LIQUID PHASE

FIG. 17

TEST NO.	H_2S (PPM)	DURATION (HR.)	TEMP. (F)	5Cr	9Cr	12Cr	316 SS	Ni200	ALLOY 600	ALLOY B
				CONDITION OF COUPONS AFTER EXPOSURE						
201*	25	2	250	G	G	G	O	DG	T	B
301*	50	2	250	G	G	G	O	G	T	G
401	25	2	250	G	G	G	G	G	G	DG
501	50	2	250	DG	DG	G	LG	G	G	DG
601	100	2	250	DG/B	DG/B	DG/B	LG	LG	B	G
701	50	2	250	DG	DG	B	LG	G	G	LG
801	75	2	250	DG	DG	DG	LG	LG	DG	G
901	100	2	300	DG	DG	DG	LG	LG	B	G
1001	75	2	300	DG	G	DG	LG	LG	B	G
1101	50	2	300	DG	DG	DG	LG	LG	B	G
1201	100	2	250	DG	DG	DG	G	G	BB	G
1301	75	2	300	G/B	G/B	G/B	G	G	B	G
1401	50	2	350	DG	DG	DG	G	G	DG	G
1501	75	2	350	DG	DG	G	G	LG	G	DG
1601	100	2	350	G/B	DG	DG	G	G	G	G

10/15

NOTEES :
O - NO ATTACK
ST - SLIGHT TARNISH
LG - LIGHT GRAY CORROSION FILM
G - GRAY CORROSION FILM
DG - DARK GRAY CORROSION FILM
B - BLACK CORROSION FILM

* COUPONS IN VAPOR PHASE

FIG. 18

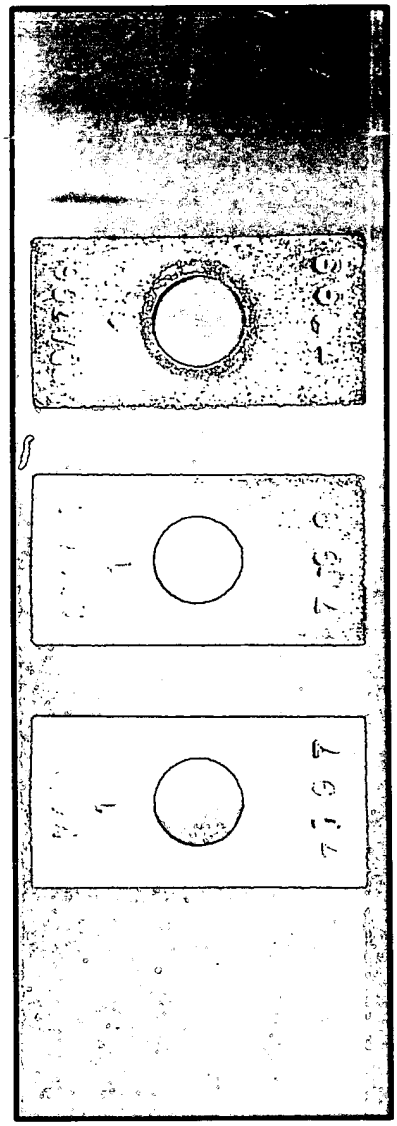

FIG. 19A

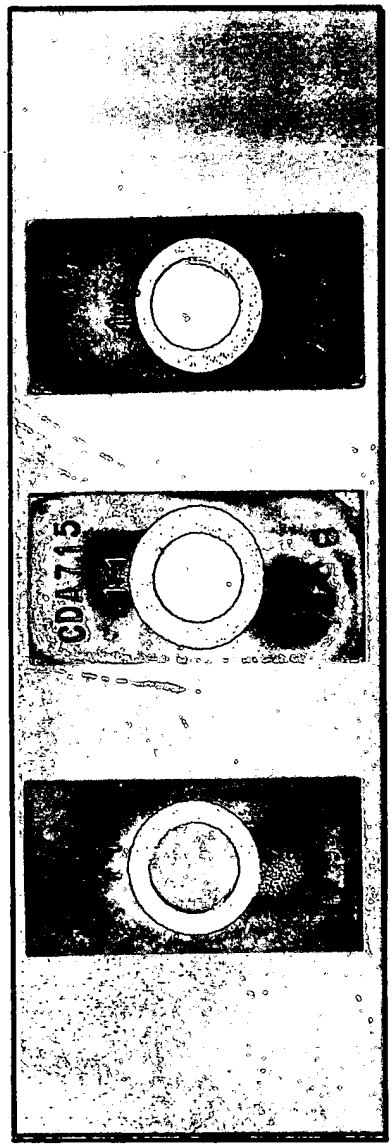

FIG. 19B

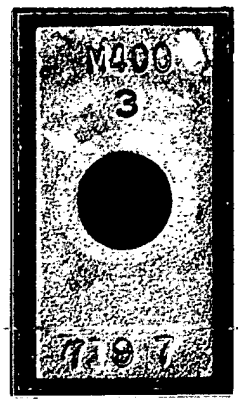

FIG. 20A

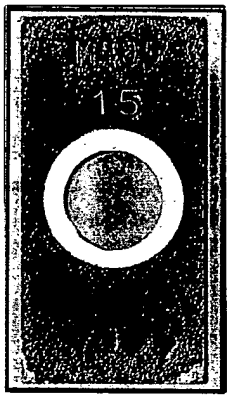

FIG. 20B

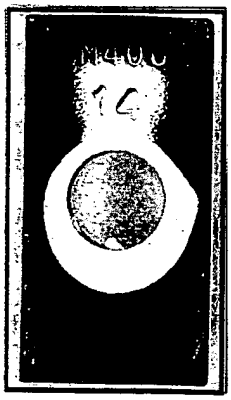

FIG. 20C

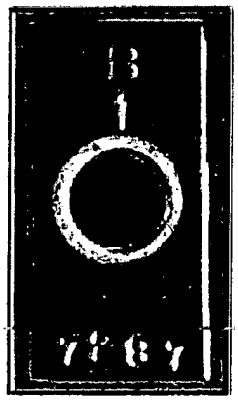

FIG. 20D

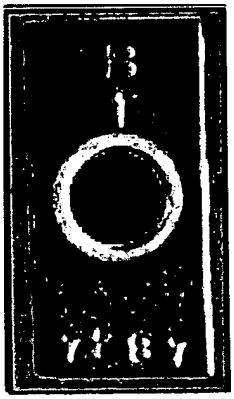

FIG. 20E

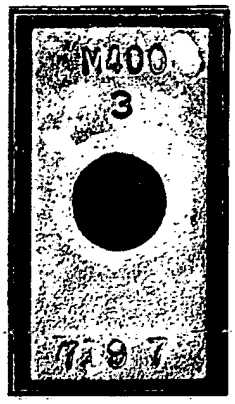

FIG. 21A

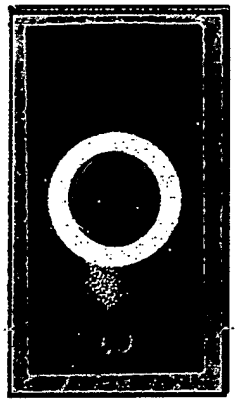

FIG. 21D

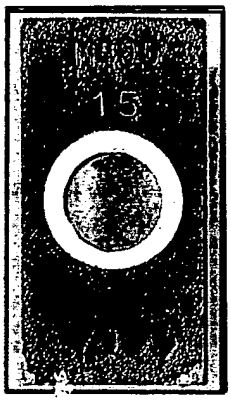

FIG. 21B

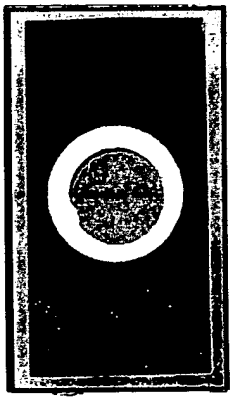

FIG. 21E

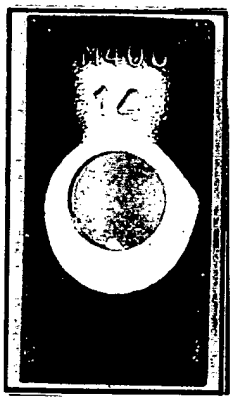

FIG. 21C

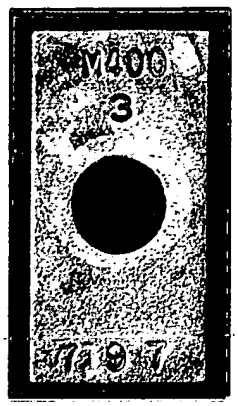

FIG. 22A

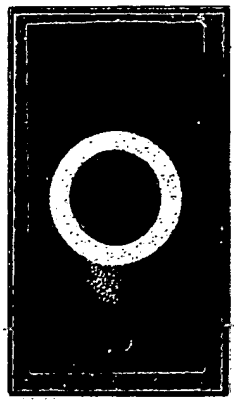

FIG. 22D

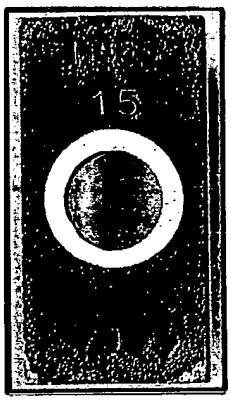

FIG. 22B

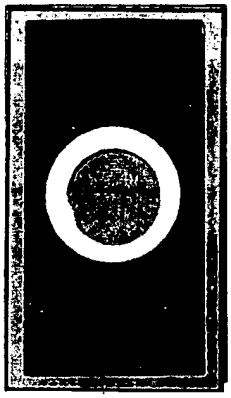

FIG. 22E

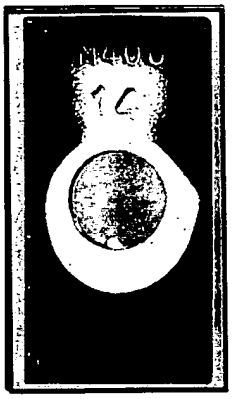

FIG. 22C

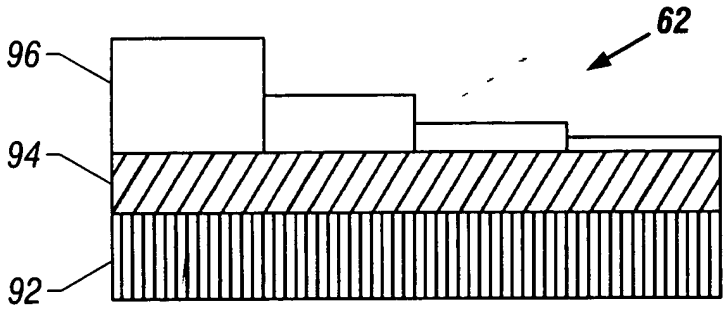

FIG. 23

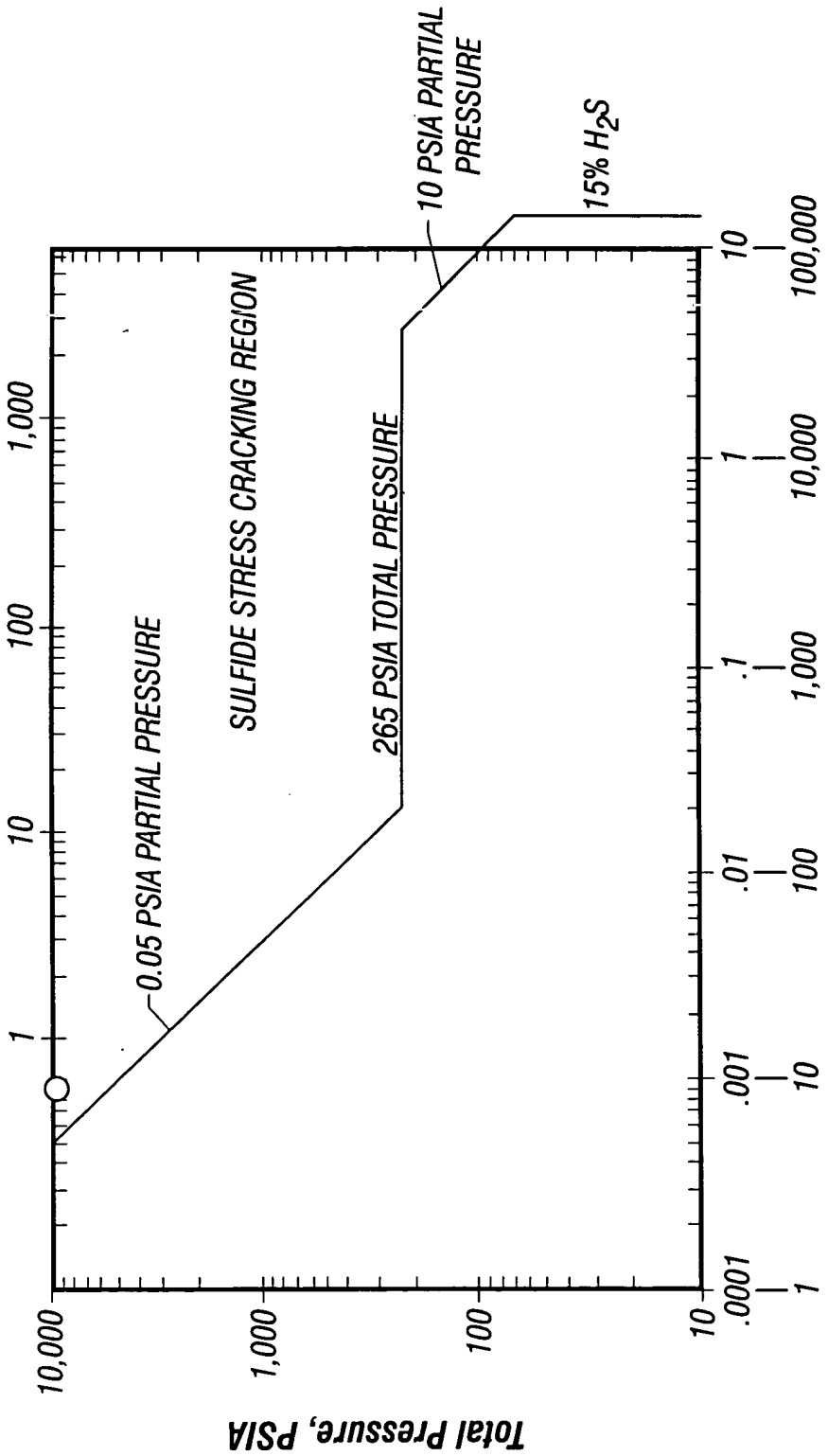
10 PSIA PARTIAL PRESSURE
15% H_2S
SULFIDE STRESS CRACKING REGION
0.05 PSIA PARTIAL PRESSURE
265 PSIA TOTAL PRESSURE
Total Pressure, PSIA
10,000
1,000
100
10
1
10
100
1,000
10,000
100,000
.0001
.001
.01
.1
1
10
100
1,000
MOL % H_2S In Gas
PPM H_2S In Gas

FIG. 1

RAW MATERIAL BAR STOCK	
ALLOY	$/lb
4130	1.0
4140	1.0
9Cr	1.5
410-13Cr	2.0
420 MOD.	2.0
17-4	3.0
304	2.5
316	3.0
S13Cr	5.0
450	6.0
918	5.5
MONEL K-500	12
925	11.5
718	12
625M	20
725	20
C-276	50
MP35N	60

FIG. 3

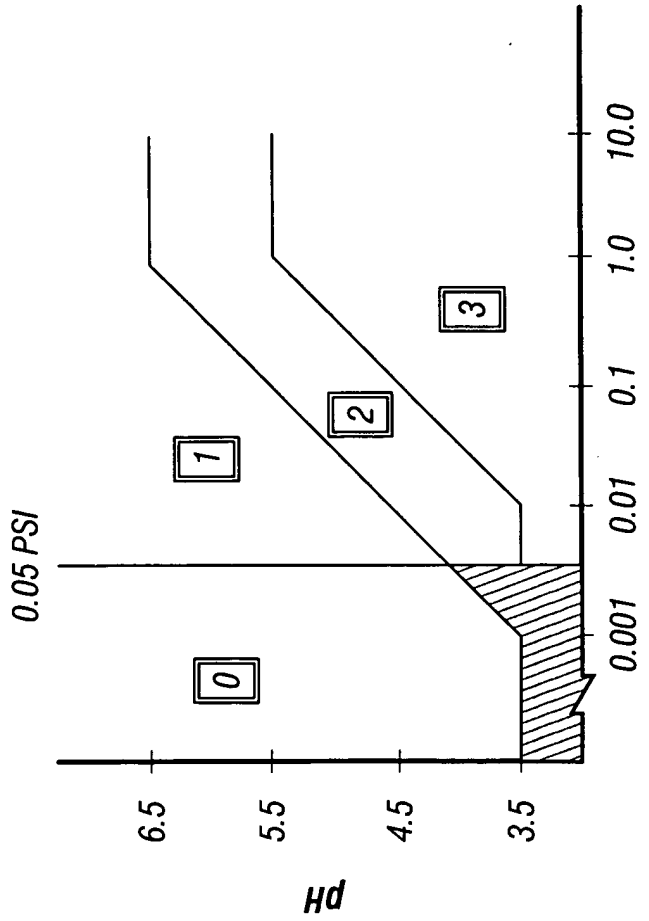

FIG. 2

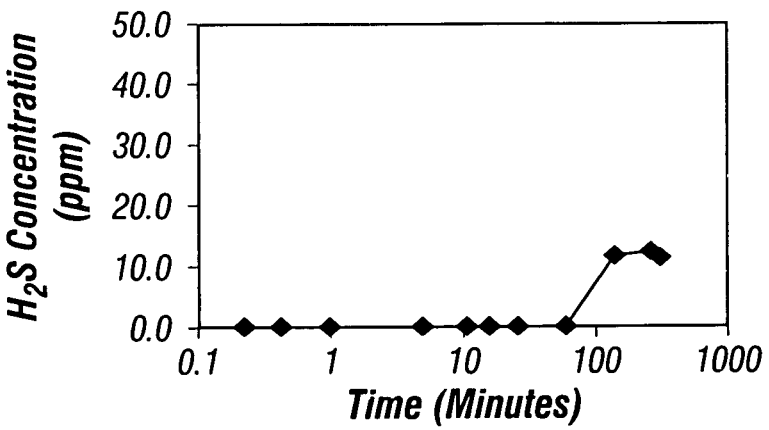

FIG. 4

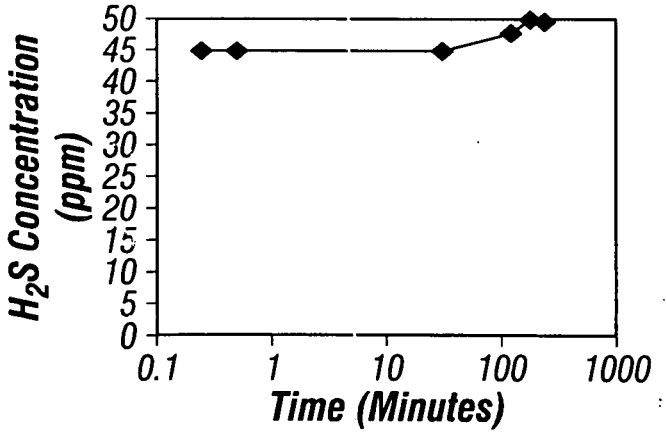

FIG. 5

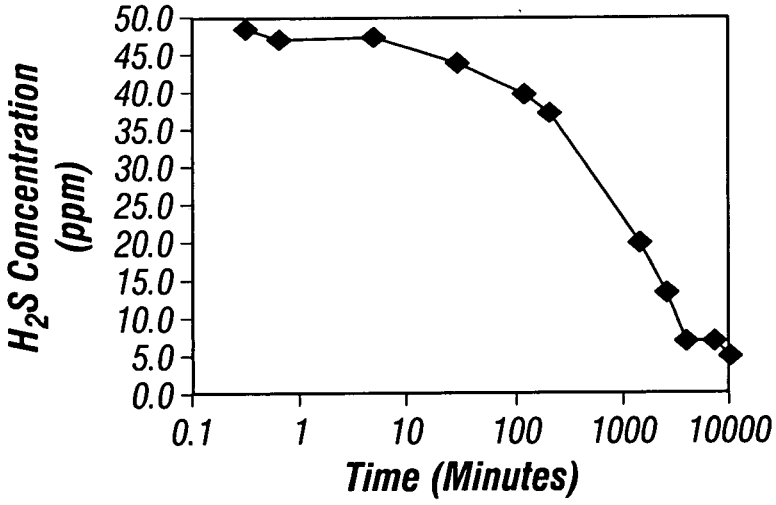

FIG. 6

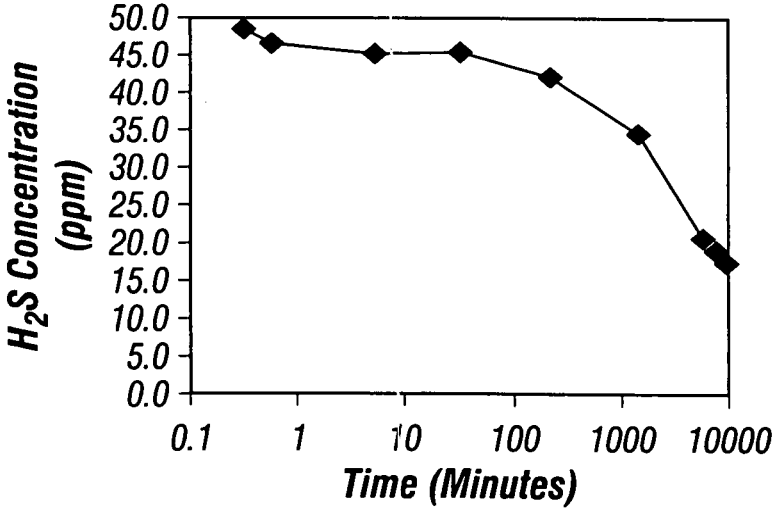

FIG. 7

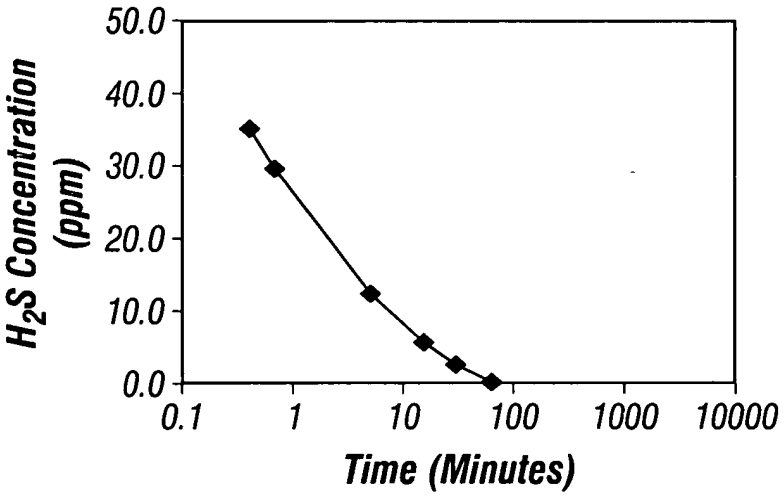
50.0
40.0
30.0
20.0
10.0
0.0
H_2S Concentration (ppm)
0.1
1
10
100
1000
10000
Time (Minutes)

FIG. 8

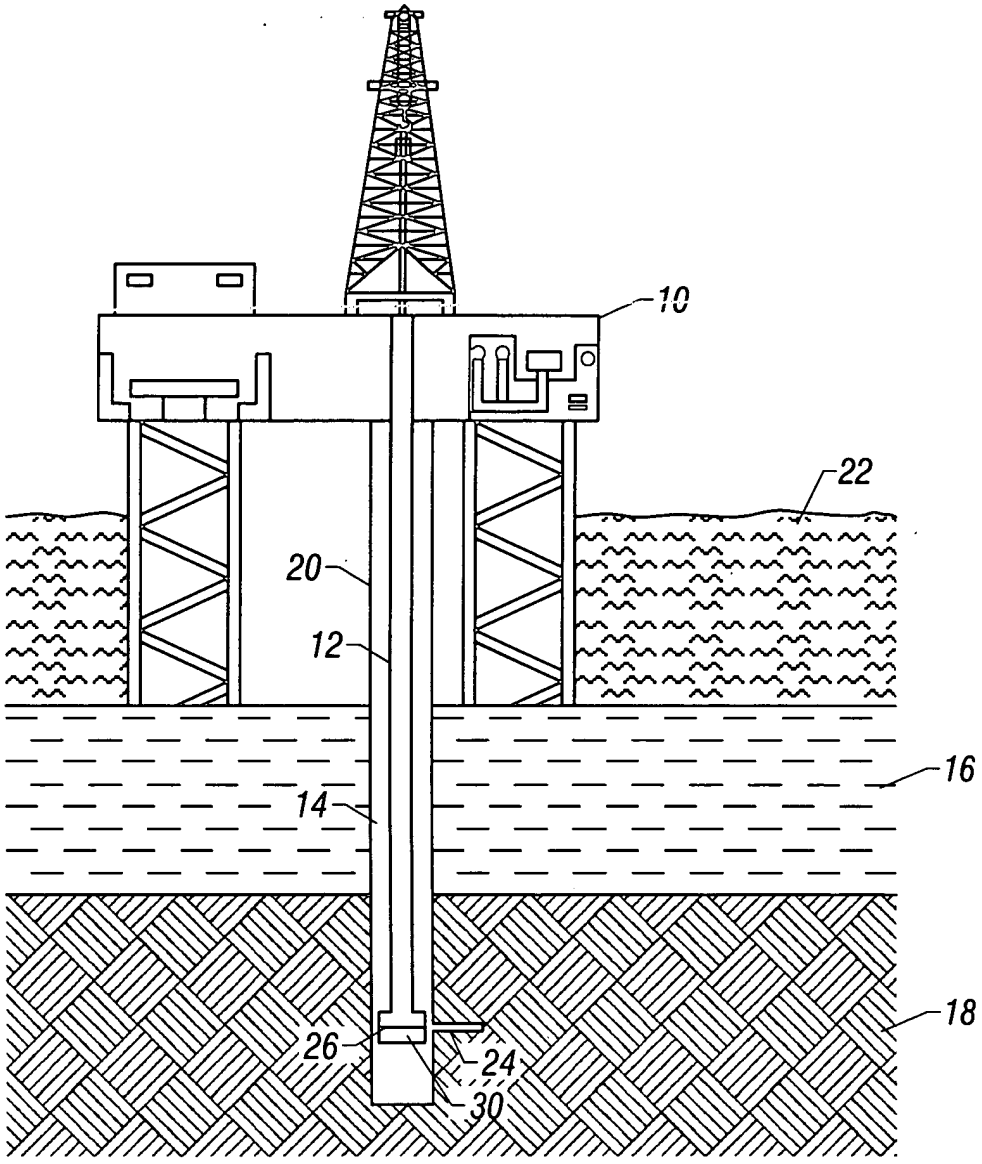

FIG. 9

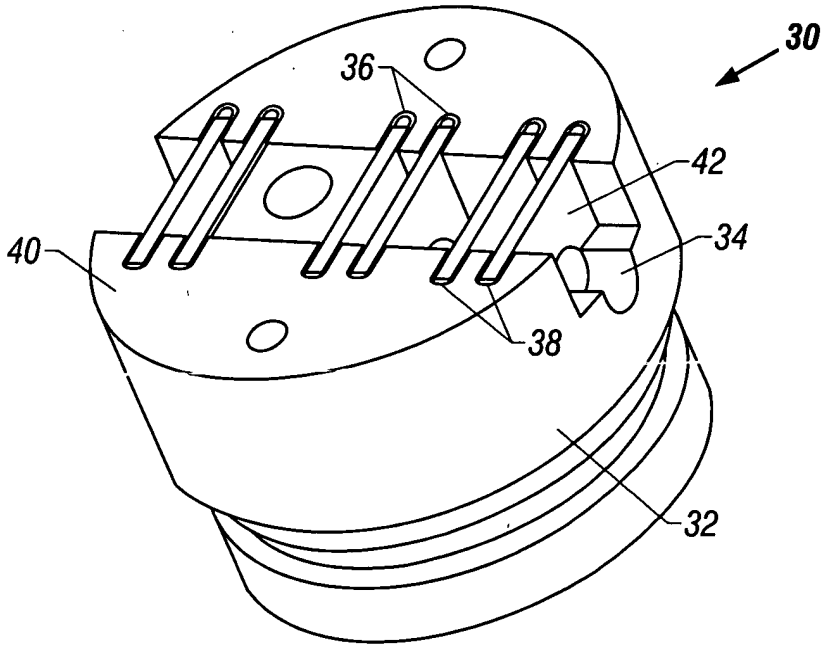

FIG. 10

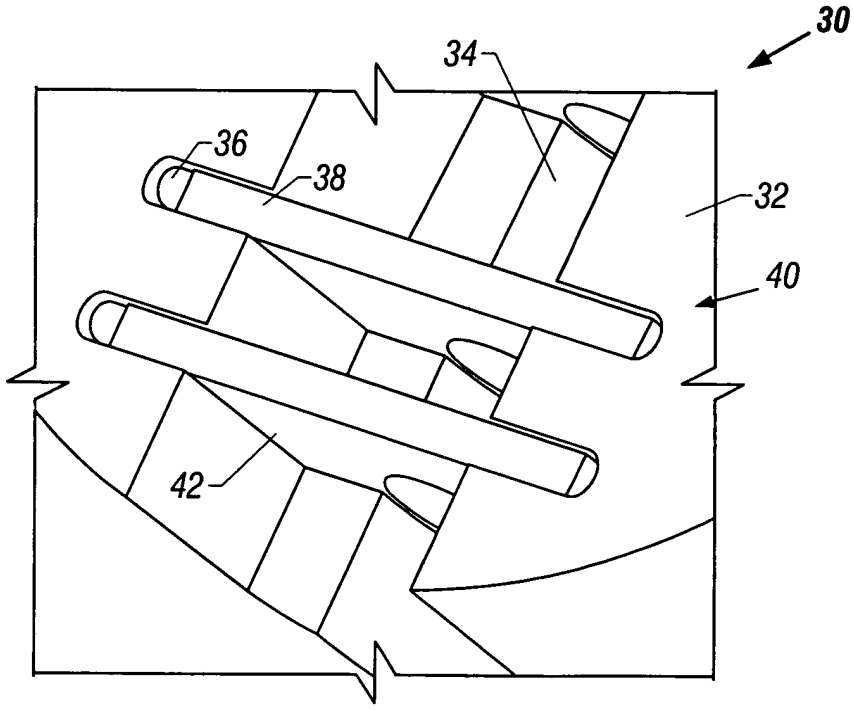

FIG. 11

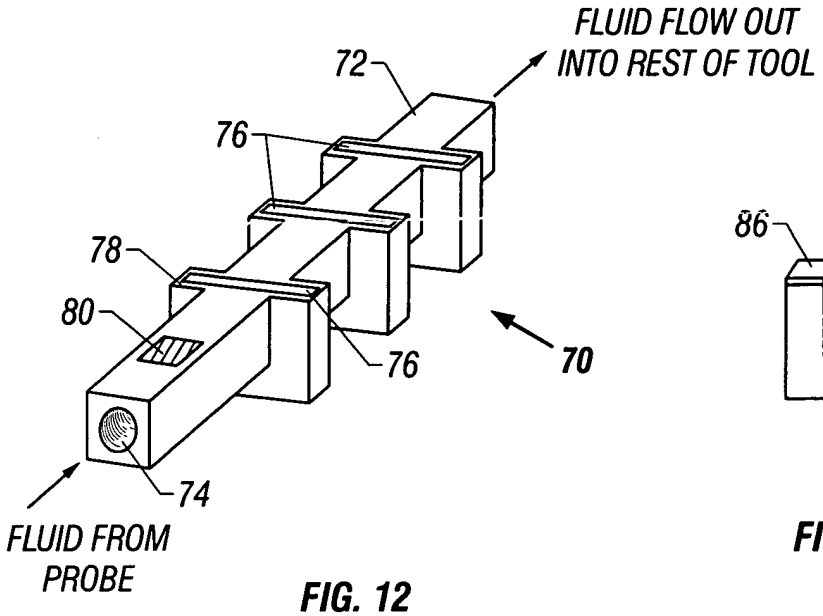

FIG. 12

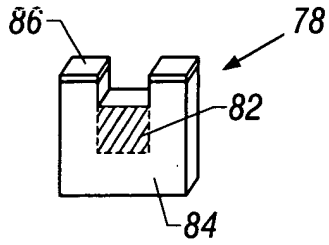

FIG. 13

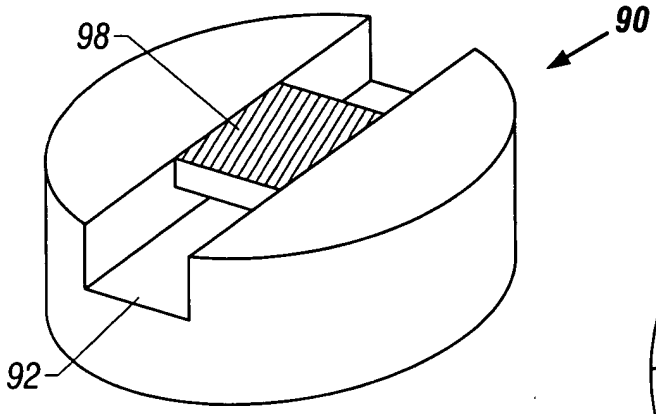

FIG. 14

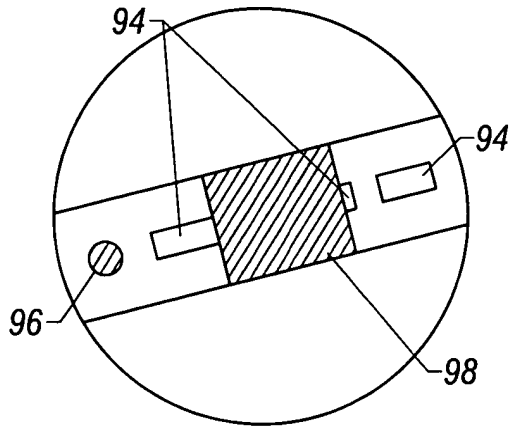

FIG. 15

ALLOY	Ni	Cu	Fe	Cr	Mo
MONEL ALLOY 400 N04400	63 - 70	BAL.	2.5 MAX.	--	--
70-30 CUPRONICKEL C71500	29 - 33	BAL.	0.4 - 1.0	--	--
90-10 CUPRONICKEL C70600	9 - 11	86.5 MIN.	1.0 - 1.8	--	--
NICKEL ALLOY 200 N02200	99.0 MIN.	0.25 MAX.	0.40 MAX.	--	--
ALLOY B N10001	BAL.	--	6.0 MAX.	1.0 MAX.	26 - 33
INCOLOY ALLOY 600 N06600	72 MIN.	.50 MAX.	6 - 10	14 - 17	--
5CR STEEL K41545	--	--	BAL.	4 - 6	0.45 - 0.65
9CR STEEL K90941	--	--	BAL.	8 - 10	0.9 - 1.1
12CR STEEL S41000	--	--	BAL.	11.5 - 13.5	--

FIG. 16

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TEST NO.	H_2S (PPM)	DURATION (HR.)	TEMP. (F)	MONEL 400	70/30 CuNi	90/10 Cu/Ni	NI 200	ALLOY 600	ALLOY B
				CONDITION OF COUPONS AFTER EXPOSURE					
1*	0	6	250	O	O	ST	--	--	--
2*	0	2	400	O	ST	ST	--	--	--
3	0	2	250	ST	ST	ST	--	--	--
4	50	2	250	G	DG	DG	--	--	--
5	0	2	300	ST	ST	ST	--	--	--
6	50	2	300	DG	G	DG	--	--	--
7	0	2	350	ST	ST	ST	--	--	--
8	50	2	350	DG	G	DG	--	--	--
9	0	2	400	ST	ST	ST	--	--	--
10	50	2	400	DG	G	G	--	--	--
11	25	2	300	DG	G	DG	--	--	--
12	25	6	300	DG	G	G	--	--	--
13	10	2	300	DG	G	G	--	--	--
14	10	2	300	DG	G	DG	--	--	--
15	5	2	300	DG	G	G	--	--	--
16	25	2	300	DG	G	DG	G	ST	DG
17	10	2	300	DG	G	DG	ST	ST	ST
18	18	2	300	DG	G	G	ST	ST	G

NOTES :
O - NO ATTACK
ST - SLIGHT TARNISH
G - GRAY CORROSION FILM
DG - DARK GRAY CORROSION FILM

* TEST CONTAINED OIL MUD AS LIQUID PHASE

FIG. 17

TEST NO.	H_2S (PPM)	DURATION (HR.)	TEMP. (F)	5Cr	9Cr	12Cr	316 SS	Ni200	ALLOY 600	ALLOY B
				CONDITION OF COUPONS AFTER EXPOSURE						
201*	25	2	250	G	G	G	O	DG	T	B
301*	50	2	250	G	G	G	O	G	T	G
401	25	2	250	G	G	G	G	G	G	DG
501	50	2	250	DG	DG	G	LG	G	G	DG
601	100	2	250	DG/B	DG/B	DG/B	LG	LG	B	G
701	50	2	250	DG	DG	B	LG	G	G	LG
801	75	2	250	DG	DG	DG	LG	LG	DG	G
901	100	2	300	DG	DG	DG	LG	LG	B	G
1001	75	2	300	DG	G	DG	LG	LG	B	G
1101	50	2	300	DG	DG	DG	LG	LG	B	G
1201	100	2	250	DG	DG	DG	G	G	BB	G
1301	75	2	300	G/B	G/B	G/B	G	G	B	G
1401	50	2	350	DG	DG	DG	G	G	DG	G
1501	75	2	350	DG	DG	G	G	LG	G	DG
1601	100	2	350	G/B	DG	DG	G	G	G	G

10/15

NOTEES :
O - NO ATTACK
ST - SLIGHT TARNISH
LG - LIGHT GRAY CORROSION FILM
G - GRAY CORROSION FILM
DG - DARK GRAY CORROSION FILM
B - BLACK CORROSION FILM

* COUPONS IN VAPOR PHASE

FIG. 18

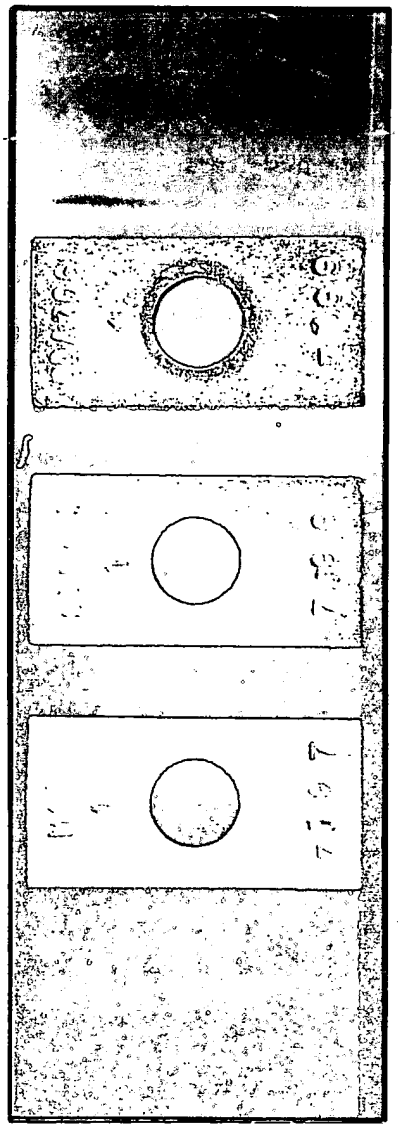

FIG. 19A

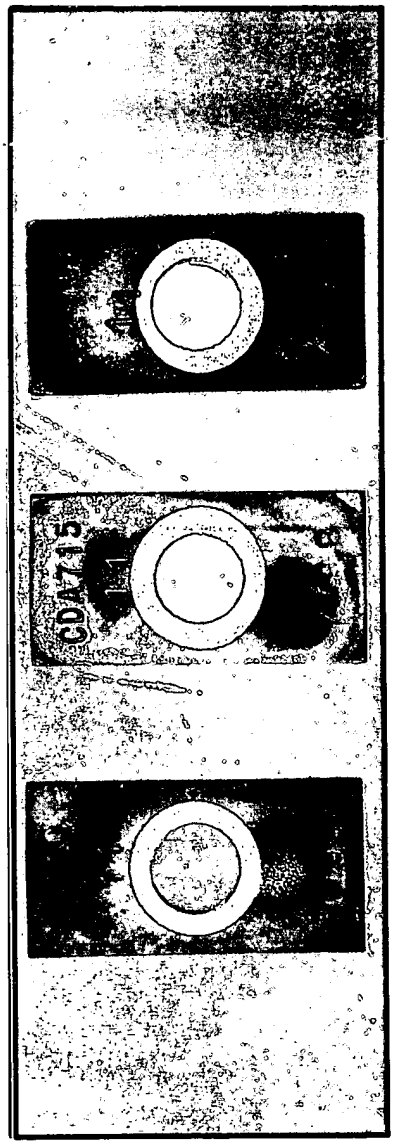

FIG. 19B

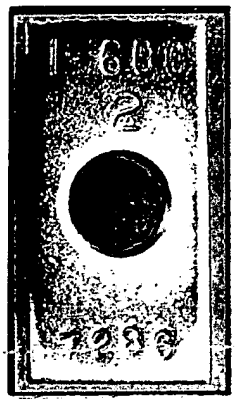

FIG. 20A

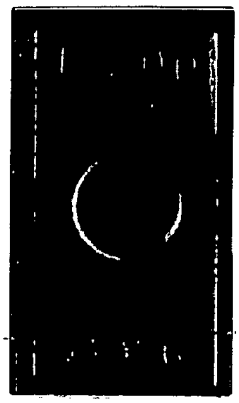

FIG. 20D

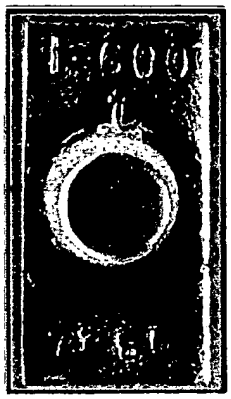

FIG. 20B

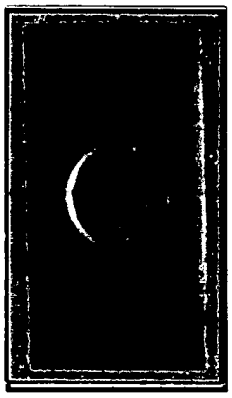

FIG. 20E

FIG. 20C

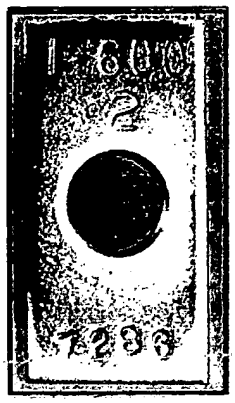

FIG. 21A

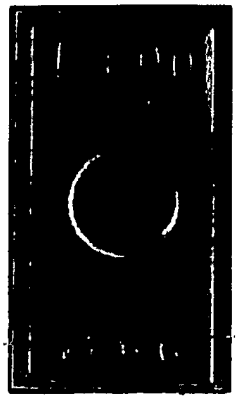

FIG. 21D

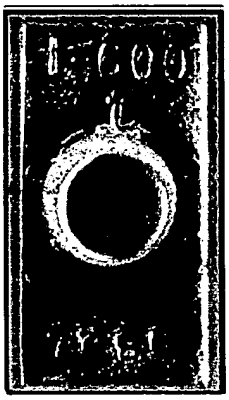

FIG. 21B

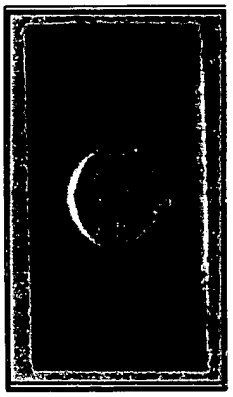

FIG. 21E

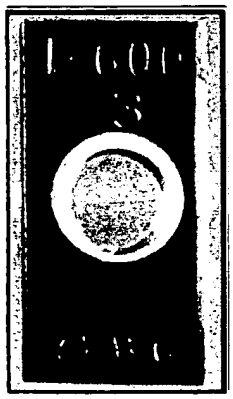

FIG. 21C

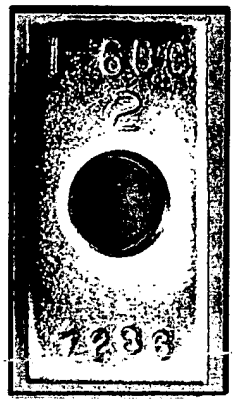

FIG. 22A

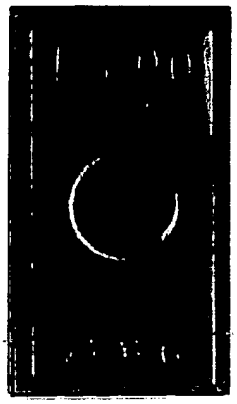

FIG. 22D

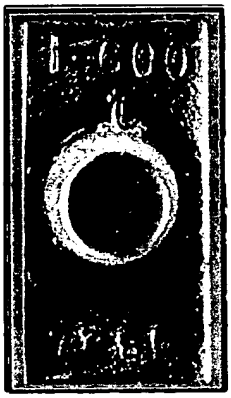

FIG. 22B

FIG. 22E

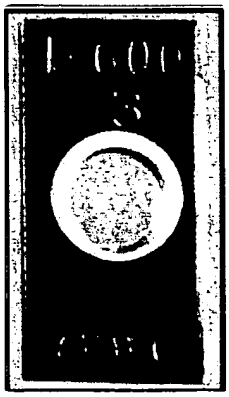

FIG. 22C

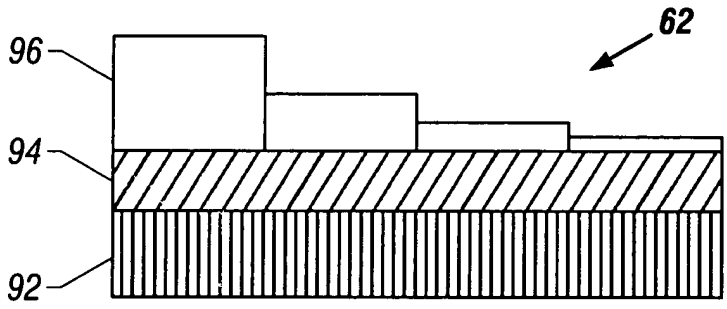

FIG. 23